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Galerkin-petrov limit schemes for the convection-diffusion equation

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Abstract

In the present paper, we suggest a method for constructing grid schemes for the multidimensional convection-diffusion equation. The method is based on the approximation of the integral identity that is used in the definition of a weak solution of the differential problem. The use of spaces of smooth trial functions and spaces of functions with possible discontinuities in which the solution of the original problem is sought naturally leads to Galerkin-Petrov methods. The suggested method for the construction of grid schemes is based on a finite-element semidiscretization of the original space with respect to space variables, which constructs the space of trial functions on the basis of the direction of the convective transport near the boundaries of finite elements, the limit passage from a scheme with smooth trial functions to schemes with discontinuous trial functions, and the further discretization of the resulting equations with respect to the time variable. We prove the stability of the constructed difference schemes and present the results of computations for model problems. © Pleiades Publishing, Ltd., 2009.

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